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Rocks of the Province of Quebec.

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By HENRY M. AMI, M. A., F. G. S.

BRYOZOA.

SOLENOPORA COMPACTA, Billings, var. MINUTA, N. var.

Zoarium, consisting of small globular or irregularly shaped masses which are apparently amorphous and compact to the naked eye, but exhibit under a microscope the typical and characteristic structure of the genus *Solenopora* (Dybowski). One of the specimens measures 5-40ths. of an inch in height and 15-40ths. of an inch in diameter, in the direction of the section which is cut partly at right angles to the tubes and partly in direction of the tubes *i. e.*, parallel to them.

The species evidently belongs to the genus of which *Solenopora compacta*, Billings, is the type, and is almost identical with it. The tubes or zoecia, however, are more closely arranged and more numerous, being proportionally smaller in the Quebec specimens than in the typical examples from the lower beds of the Trenton formation of other portions of Canada. The tubes in the examples from Quebec also appear to be more tortuous, and at times resemble the

¹ N. B.—Throughout the text, the terms, *cell*, *intertitial cell*, *zoecium*, *spini-form tubuli*, etc., have been used by the writer in order to be uniform with the terminology employed by Mr. Foord, in his "Contributions to the Micro-Palaeontology of the Cambro-Silurian rocks of Canada," 1883. I very much prefer the terms "*autopores*," "*mesopores*," "*acanthopores*," etc. now employed by Messrs. Foord, Ulrich and other authors.

structure observed in such forms as *Girvanella* or *Strephochetus*. Of the genus *Solenopora*, there appear to be two, and perhaps three distinct forms from the Cambro-Silurian or Ordovician strata of Canada.

1. One of these, the typical *Solenopora compacta*, Billings, sp. (= *Stromatopora compacta*, Billings; = *Stenopora compacta*, Dawson; = *Tetradium Peachii*, Nich. and Etheridge; = *Solenopora spongioides*, Dybowski; = *Tetradium Peachii*, var. *Canadense*, Foord; (*Cymatopora compacta*, Dwight, M.S.S.) occurs in abundance through a considerable thickness of the lower beds of the Trenton of Ontario and Quebec, and has zoecia varying from 1-320 th. to 1-400 th. of an inch in diameter, whilst the Scotch representative described by Dr. Nicholson and Mr. Etheridge, jr., has zoecia which measure 1-420 th. of an inch—"one-thirty-fifth of a line"—in diameter.

2. A second species of this genus *Solenopora*, occurs in the limestones of the Bird's Eye and Black River formation at Paquette's Rapids, on the Ottawa River. This locality is referred to by Billings as one of the places where this *Stromatopora* (now *Solenopora*) *compacta* could be found, and gives no figure nor microscopic characters whereby the species may be recognized. Now that *Solenopora compacta*, Billings sp., is a well established species which finds place in the nomenclature of present writers, it appears from an examination of microscopic sections of the Paquette Rapids form, that it is distinct from the ordinary form and is readily distinguished therefrom by the large size of its zoecia—they vary from 160 to 200 in the space of one inch, *i. e.*, each zoecium varies from 1-160th. to 1-200th. of an inch in diameter. The specific name *Solenopora Paquettiana*, is here proposed to receive such forms as this which present the generic characters of the genus *Solenopora*, but have zoecia or tubes much larger than in *S. compacta*, and also less wavy. The zoarium is also considerably larger than ordinary specimens of *S. compacta*. No diaphragms have been detected in the longitudinal section of this form. There must obviously have been diaphragms

at more or less regular intervals in the tubes, but, as in most specimens of *S. compacta*, they are not evident. Very skilfully prepared sections of especially well preserved examples from the Trenton rocks of Poughkeepsie, N. Y., kindly presented to the writer by Prof. W. B. Dwight, of Vassar College, have revealed the tabulae of *S. compacta*.

3. The third form occurs in the hard compact cherty limestone rocks of Quebec city at Côte d'Abraham, and closely resembles the type species *S. compacta*, but is clearly distinct from *S. Paquettiana*, both from the size and regularity of its tubes. From *S. compacta*, the Quebec variety '*minuta*,' differs in having smaller zoecia, less regularly arranged and often very tortuous. There are from 480 to nearly 600 tubes in the space of one inch, and these are all in close contact. No septal teeth or spiniform projections from the wall inwardly have been detected in any of the zoecia, which are irregularly rounded polygonal and triangular at times.

Under the microscope this form, *S. compacta*, var. *minuta*, may be readily distinguished from the other two species, and on this account has had the varietal designation affixed.

Locality.—Côte d'Abraham, Quebec City, Quebec.

Collectors.—H. M. A. and N. J. Giroux, 1888.

Micro Sections.—2,110 and 2,115. Prepared by Mr. T. C. Weston.

DICRANOPORA PARVA, N. SP.

Length of the only specimen (fragment) examined: .175 inch; breadth, .05 of an inch. There are from six to eight rows of cells across the polypary which are obliquely disposed in lines, so as to give to the zoerium a quincunxial arrangement which is characteristic and evident. Between the cell apertures, whose margins are somewhat thickened, are seen low depressed and indistinct lines which give a slightly longitudinal aspect to the rows of cells, besides the oblique or quincunxial disposition. This form appears to be distinct from those described by Mr. Ulrich from the Cincinnati group of Ohio, and the name *D. parva* is here suggested for this form.

Locality.—Gagnon's Beach, near the boundary between Matanne and McNider Townships, Quebec.

Collector.—T. C. Weston, 1887.

PRASOPORA LYCOPERDON, Vanuxém var. SELWYNI,
N. VAR.

Zoarium sub-hemispherical, massive, about half an inch in diameter and the same dimension in height; tubes erect, prismatic.

Tangential or cross section. This section exhibits the characters and general features of the genus *Prasopora*, Nich. and Ether, jr. The zoecia are polygonal however, and in close contact with one another, there being only an occasional interstitial cell developed between the zoecia. This almost total absence of interstitial cells, so prominent and characteristic in typical examples of *Prasopora lycoperdon*, Vanuxém, (=P. Selwyni, Nicholson), from the Trenton formation of Canada and the United States, differentiate the Quebec species or variety from the typical species.

Longitudinal section. This section shows the characters of *P. lycoperdon*, save the smaller or interstitial cells with closely arranged tabulae which appear to be wanting. The curious oblique funnel-shaped or invaginating diaphragms with tabulae developed in them at different heights, are exceedingly striking and characteristic; some of the zoecia present horizontal and straight diaphragms from wall to wall. There are about 72 zoecia in the space of one inch, or each zoecium is .0138 inch in diameter. In this character this variety comes closer to the smallest representatives of the type (*P. lycoperdon* Vanuxém or *P. Selwyni* of Nicholson), which are 1-70th of an inch in diameter.

Locality.—In the hard cherty limestone bands of Côte d'Abraham, Quebec City, Quebec.

Collectors.—H. M. A. and N. J. Giroux, 1888.

Micro sections.—Nos. 2,107, 2,108, 2,109, 2,116. Prepared by Mr. T. C. Weston.

DIPLOTRYPA QUEBECENSIS, N. SP.

Zoarium sub-hemispherical, base concave, height about two lines, diameter about half an inch.

Tangential or cross section. Zoecia about 1-60 th. inch in diameter, varying from 1-50 th. to 1-75 th. of an inch. In shape, the zoecia are polygonal, but often circular, mostly in contact, but at times one zoecium is almost completely isolated by the presence of interstitial cells, which are developed throughout the zoarium but in greater number in certain portions of it. The interstitial cells vary considerably in shape, size and distribution, being often triangular, hour-glass shaped, and four, five, and even six sided at other times. No spiniform tubuli are seen in this section.

Vertical or longitudinal section. The tubes are perpendicular to the base of the zoarium and regularly disposed. The walls are comparatively thick, and especially in the upper portion of the zoarium. The zoecia have a few distinct horizontal or slightly curved tubule or diaphragms, whilst the interstitial cells have more numerous and horizontal diaphragms developed.

NOTE. The paucity of tubuli in the specimen examined may be due to its state of preservation or fossilization, as the few that are seen in the zoecia are only faintly visible in the coarsely crystalline calcite which fills the tube. No spiniform tubuli are seen in this section.

This species is most nearly related to *Diplotrypa Milleri*, Ulrich, but differs therefrom in possessing much fewer diaphragms, both in the zoecia and in the interstitial cells.

It differs also from *D. Whiteavesii*, Nicholson, *D. Petropolitana*, Pander, *D. regularis*, Foord, and *D. infida*, Ulrich, in possessing no spiniform tubuli.

Locality.—In the hard calcareous beds of Côte d'Abraham, Quebec City

Collectors.—H. M. A. and N. J. Giroux, 1888.

Micro sections.—2,113. Also prepared by Mr. T. C. Weston.

MONOTRYPA INCERTA, N. Sp.

Zoarium, small, sub-cylindrical or irregularly elongate sub-spherical, height, .25 inch; longer diameter, .375 inch; shorter diameter, .25 inch.

Tangential section. In tangential sections, the zoecia are seen to be regularly polygonal of uniform size, and apparently of one kind only. The walls around each are clearly visible and are only moderately thickened. Occasionally a smaller zoecium is developed between the larger ones, but appears to be only an immature zoecium and differs in no respect from the larger or proper zoecia. There are no interstitial cells at all. The other generic characters are also evident.

Longitudinal section. This section exhibits the uniform prismatic character and regular size of the tubes. Diaphragms are tolerably numerous and straight, whilst at times they have a decided curvature. These are distant from each other one tube diameter or thereabouts.

The zoecia are .0156 inch in diameter, or number 64 in the space of one inch, as measured both in the tangential and longitudinal sections.

Locality.—In the hard compact cherty beds of limestone of Côte d'Abraham, City of Quebec, Quebec.

Collectors.—H. M. A. and N. J. Giroux, 1888.

Micro sections.—2,111, 2,112 and 2,114. Prepared by Mr. T. C. Weston.

DOUBTFUL SPECIES.

Besides the foregoing species of Monticuliporidae and Bryozoa which were obtained from the hard calcareous band of Côte d'Abraham, Quebec, there occur in addition, two forms whose generic and specific affinities are still doubtful, since the material from which Mr. Weston prepared the microscopic slides which contains both is somewhat imperfect and poorly preserved, most of the structure of one polypary having been obliterated in the one, and in the other case the matrix is very granular, which fact gives a granular and obscure aspect to the organism. The spe-

cimen from which the slide was prepared, was obtained also from Côte d'Abraham, Quebec, and the number of the slide or section is 2,117. For reference sake the two forms are designated A. and B. respectively.

FORM A.

GENUS? — SPECIES? —

This form consists of a small, narrowly cylindrical or slightly flattened polypary, with one row of rather deeply and obliquely situate cells on each side of the median axis or line which separates the zoarium into two parts. The zoarium measures seven-sixtieths ($\cdot 116$) of an inch in diameter, whilst the width of the zoecia or tubes at their aperture measures less than 1-100th. of an inch in diameter. The polypary is obtusely rounded at one extremity—the distal extremity of the zoarium—and the cells are inclined at an angle of about 45° to the median axis. No evidence of tubulæ or diaphragms of any sort have been observed in the section. The micro-copic section shows the skeletal parts of the polypary to be fibrous in structure. In a general way, this form appears to belong to the family of *Ptilodictyonidae*, but its generic and specific affinities are still unknown.

FORM B.

GENUS? — SPECIES? —

This form consists of small sphaeroidal or irregularly shaped masses which present an exceedingly minute, yet recognisable radiating tube-like structure with faint indications of concentric lines. The zoarium (?) appears to have certain affinities to the genus *Solenopora*, Dybowski, but differs therefrom in the size and distribution of the corallites (?) and in several other points. It has also been compared with *Girvanella* and allied forms, but although poorly preserved, shows salient characters of difference.

In examining and re-classifying the genera and species of Monticuliporida in our collections, a similar form was observed in *Micro-section* 804, prepared by Mr. Weston from a

specimen of Trenton limestone collected at Hull, Quebec, by Mr. W. R. Billings in 1882, alongside a species of *Heterotrypa*, probably *H. solitaria*, Ulrich, which designation Mr. A. H. Foord has attached to the slide holding the large polypary. Though more irregularly shaped in outline than the Quebec City specimen, the Hull one is evidently and easily seen to be congeneric and co-specific with it. Along the outer portion of the zoarium, the radiating tubes (?) or zoecia (?) are more clearly visible, whilst the central portion is occupied by more or less regular (somewhat granular) network which resembles a reticulate structure. The diameter of the Quebec City specimen is .0146 of an inch. The matrix in which both the Hull and the Quebec specimens are preserved, is such as to obliterate such a minute structure as the zoarium (?) evidently possessed. When found imbedded in a finer grained rock, the exact relations and true affinities of this interesting form will, it is hoped, be more definitely ascertained.

PALÆONTOLOGICAL NOTES.

By HENRY M. AML, M.A., F.G.S.

I.

ON A COLLECTION OF FOSSILS FROM THE ORDOVICIAN OF JOLIETTE,
IN THE PROVINCE OF QUEBEC.

In the "Geology of Canada" for 1863, Sir William Logan has given several interesting notes on the structural relations of the rocks about Joliette (or "Industry" as it is sometimes called,) and has also shown that the Chazy, the Bird's Eye and Black River as well as the Trenton terranes all occur there along the shores of L'Assomption River, whose rapid flowing stream affords magnificent water power for saw and carding mills, a foundry and an important paper factory.

These *three* Ordovician terranes are beautifully exposed along the cliffs and banks of L'Assomption River, from under and close to the mill above the 'upper bridge' to the

'old mill' or 'Vieux Moulin,' some two miles below the town. Some excellent building stone has been extracted and is still being quarried out, well adapted for railway bridges, piers and dwellings, whilst the more crystalline beds in the Desmarais quarries afford a superior quality of lime when burnt.

THE CHAZY.

The Chazy terrane is characterized by Sir William Logan as gradually thinning out in this section of Canada—being visible and estimated at a thickness of some *thirty* feet only—and holding a fossil which Mr. Billings recognised as the *Pleurotomaria staminea*, of Hall—now better known as a *Raphistoma*, *R. staminea*, Hall, sp.

This species is eminently characteristic of the Chazy in many parts of Canada and the United States—so that its presence leaves no doubt as to the occurrence of the Chazy at Joliette. It is hoped that future investigations will afford more ample material wherewith to describe this most interesting series which gradually dies out a little farther east and reappears some 500 miles down the St. Lawrence—at the Mingan Islands, north of Anticosti.

THE BIRD'S EYE AND BLACK RIVER.

The Bird's Eye and Black River terrane of Joliette consists of *fifty* feet of limestone holding the well known and typical fossil corals, viz: *Columnaria Halli*, Nicholson, and *Tetradium fibratum*, Safford. These fifty feet of strata form the base of Sir William Logan's Trenton in this district whose total thickness he estimated at 480 feet.

THE TRENTON.

During the summer of 1881 the writer had an opportunity afforded him of examining the beautiful exposures of this highly fossiliferous terrane along the banks of L'Assomption River for a distance of some three miles, and obtained quite an interesting suite of specimens which it is proposed to place on record in this paper.

No Trenton fossils are described or referred to by Sir Wm. Logan in the volume cited above.

The Trenton, however, is therein described and subdivided into three sections in descending order as follows :—

	Feet.
(a.)—Evenly bedded and dark coloured limestone.....	200
(b.)—Nodular limestone	140
(c.)—Gray coloured limestone.....	90
Total.....	430

From a collection made at "Industry Village," in 1852, by Sir William Logan, the following forms have been determined by the writer :

1. *Strophomena alternata*, Conrad.
2. *Leptaena sericea*, Sowerby.
3. *Orthis testudinaria*, Dalman.
4. *Asaphus Canadensis*, Chapman.

It would thus appear from the above list that we have here strong evidence for the presence of the upper beds of the Trenton with the probable existence of the Utica terrane. The occurrence of *Asaphus Canadensis*, Chapman, indicates close proximity to the Utica, if not indeed the actual presence of that terrane. These facts, therefore, point to a higher horizon than had hitherto been indicated in the "Geology of Canada" above cited.

The following list of Trenton fossils is based upon the collection made by the writer in 1881—at the quarries near the "Pont des Dalles"—and at the old mill, some two miles down the river below this bridge. As can be readily seen they are eminently characteristic species. I have no doubt that this list could be swollen to larger proportions as the rocks are highly fossiliferous and the specimens in a very good state of preservation.

The occurrence of orthoceratites several feet in length and in abundance, and of beautifully preserved and large specimens of *Conularia Trentonensis* is especially worthy of note.

LIST OF TRENTON FOSSILS FROM JOLIETTE, QUE.

1. *Diplograptus* cf. *D. putillus*, Hall.
2. *Solenopora compacta*, Billings, sp.
3. *Stictopora acuta*, Hall.
4. " *sp. indt.*
5. *Ptilodictya maculata*, Ulrich.
6. *Monotrypella Trentonensis*, Nicholson.
7. *Prasopora lycoperdon*, Vanuxem.
8. *Amplexopora Canadensis*, Foord.
9. *Serpulites dissolutus*, Billings.
10. *Glyptocrinus ramulosus*, Billings.
11. *Orthis plicatella*, Conrad.
12. " *testudinaria*, Dalman.
13. *Strophomena alternata*, Conrad.
14. *Leptæna sericea*, Sowerby.
15. *Conularia Trentonensis*, Hall.
16. *Cyclonema bilix*, Hall.
17. *Trochonema umbilicatum*, Hall.
18. *Pleurotomaria Progne*, Billings.
19. *Endoceras proteiforme*, Hall.
20. " *multitubulatum*, Hall.
21. *Calymene seneria*, Conrad.
22. *Asaphus platycephalus*, Stokes.
23. *Illenus* cf. *I. Milleri*, Billings.
24. *Ceraurus pleurexanthemus*, Green.

NOTE.—The strata in the neighbourhood of the rapids and falls below the town point to the existence of local faulting or dislocations, as they are considerably disturbed and are seen to dip to as high an angle as 60° to the S.W. L'Assomption River is one of those post-tertiary streams which is fast cutting its way through the Leda clay and Saxicava sand terranes, as also through the uppermost members of the Cambro-Silurian or Ordovician system in the higher levels.

II.

ON THE OCCURRENCE OF FOSSIL REMAINS ON THE MANITOU ISLANDS, LAKE NIPISSING, ONTARIO.

The Manitou Islands—which form a group of six beautiful Islands—are pleasantly situated in the basin of Lake Nipissing, Ontario, and are easily reached by way of North Bay, an important railway centre along the line of the Canadian Pacific Railway. Whilst the shores of Lake Nipissing are completely made up of Archæan rocks, these islands are seen to consist at several points of sedimentary strata which when examined are found to be rich in fossil remains and indicate with tolerable precision the horizon or period when these strata were laid down.

The occurrence of *Tetradium fibratum*, Safford; *Columnaria Halli*, Nicholson; *Ormoceras Bigsbyi*, Stokes, and an obscure specimen of *Goniceras anceps*, Hall, suggest the natural inference that the limestone beds of these islands belong to the Black River formation.

The early, and, perhaps, only record of fossiliferous limestones on these islands “holding *Orthoceras* with a few obscure fossils” may be found in Alex. Murray’s report to Sir Wm. Logan for the year 1854¹ “*Ormoceras tenuifilum* of Hall” is therein noted with considerable certainty and the strata consequently referred to the Black River formation.

The collection upon which the following list of species of fossils is based, was made in the summer of 1884 by Dr. A. R. C. Selwyn who was assisted by Mr. H. P. Brumell. They comprise seventeen species of Ordovician fossils characteristic of the Black River formation as follows:—

LIST OF SPECIES.

1. *Columnaria Halli*, Nicholson.
2. *Tetradium fibratum*, Safford.
3. ? *Coscinium proavium*, Eichwald.

¹ Report of Progress, Geol. Surv. Can. 1853-54 55-56, p. 124.

4. *Stictopora acuta*, Hall.
5. *Ptilodictya recta*, Hall.
6. *Amplexopora Canadensis*, Foord.
7. 8. Several species of *Monticuliporidae*.
9. *Streptorhynchus filitextum*, Hall.
10. *Rhynchonella increbescens*, Hall.
11. *Ecculiomphalus Trentonensis*, (?) Conrad
12. *Pleurotomaria subconica*, Hall.
13. *Ormoceras Bigsbyi*, Stokes.
14. " (?) *fusiforme*, Hall.
15. *Endoceras multitubulatum* (?) Hall.
(= *Vaginoceras multitubulatum*, H. sp.)
16. *Endoceras proteiforme*, Hall.
17. (?) *Gonioceras anceps*, Hall.

Note.—The Rev. J. M. Goodwillie, M.A., who resided in North Bay some years has just informed me that he has made an extensive collection of fossil remains from these islands, so that additional forms will doubtless be found when the collection is examined.

OTTAWA, Feb. 1892.